

**The Holocene palaeolimnology of Lake Fidler,  
a meromictic lake in the cool temperate  
rainforests of south west Tasmania**

**by**

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**Submitted in fulfilment of the requirements for the degree of**

**Doctor of Philosophy**

**University of Tasmania, September 1995**

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## DECLARATION

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A handwritten signature in black ink, reading "Dominic A. Hodgson". The signature is written in a cursive style with a large initial 'D'.

Dominic A. Hodgson, September 1995

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Fallen trees in every direction had interrupted our march, and it is a question whether human beings either civilised or savage had ever visited this savage looking country. Be this as it may, all about us appeared well calculated to arrest the progress of the traveller, sternly forbidding man to traverse those places which nature had selected for its own silent and awful repose.

Jorgen Jorgenson 19th March 1827.

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## ABSTRACT

Lake Fidler is situated adjacent to the lower Gordon River in the Franklin Lower Gordon Wild Rivers National Park of south west Tasmania. It is the only stable meromictic lake in cool temperate rainforest in Australia and facets of its unique biology, phycology and limnology have been abundantly published in over 20 scientific papers. This study uses palaeolimnological techniques to place existing knowledge in the context of the long term history and evolution of Lake Fidler. This has allowed an assessment of the impact of modifications to the hydro-dynamics of the river, by a dam further upstream, on the declining meromictic stability of the lake. The study comprises two parts. The first part describes the use of remote data loggers to monitor the hydro-dynamics of the lake and river and the ectogenic mechanism which maintains meromixis through periodic incursions of brackish water. This has resulted in recommendations for a management strategy to prevent the further decay of meromixis. The second part, a palaeolimnological study, reconstructs the history of meromixis and the palaeoecology of the lower Gordon River region. A 17metre sediment core, dating back 8000years, was analysed for fossil diatoms and pigments. Fossil diatoms provided specific information on the genesis of the lake from a brackish riverine backwater to an autonomous meromictic lake with a fresh water mixolimnion dominated by *Cyclotella stelligera*. The ultimate stability of this freshwater mixolimnetic assemblage is interpreted as the time at which the lake became permanently stratified. The development of biological communities associated with meromixis was also studied using fossil pigments. The most diagnostic pigments were the bacteriochlorophylls of the anaerobic green phototrophic sulphur bacteria, *Chlorobium limicola* and *Chlorochromatium aggregatum*, which obligately require the conditions of the chemocline to maintain their abundance. The establishment of these organisms concomitant with the development of permanent stratification also confirms the onset of meromictic conditions. The palaeolimnological studies, in tandem with studies of fossil pollen, have additionally provided information on the Holocene palaeoecology and palaeoclimatology of south west Tasmania during the later phases of Aboriginal occupation. This included the possible evolution of a warmer and wetter climate and the development of a mature cool temperate rainforest in floristic refugia that have remained undisturbed since the last ice age.

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## ACKNOWLEDGMENTS

Professor Peter Tyler, with his students and colleagues, has studied the lakes of the lower Gordon River for almost 20 years. This work provided an invaluable and clear starting point for the present thesis. I am indebted to Peter for his boundless enthusiasm, for reviewing my manuscripts, despite living "in great haste", for introducing me to the invigorating wilderness of south west Tasmania and for both his and Grace's friendship.

The fieldwork would not have been a success without the considerable experience of Rob Walsh, and Peter Tyler and the willing help of Karen Westwood, Lynda Bellchambers, Louise Hodgson, Mark Hodgson, Deborah Nicholls, Victoria Cracknell, Samantha Browne and Katharina Van Moort. Trevor Norris and Paul Helleman of The Department of Parks, Wildlife and Heritage, Steve Langshaw and Kevin Pearce of Wilderness Air, and Troy and Guy Grining, operators of the Heritage Wanderer in Strahan, all provided logistical support.

Wim Vyverman cast a critical eye over my diatom taxonomy on several occasions and in collaboration with Ruth Vyverman and Peter Tyler this has resulted in several publications describing the Tasmanian diatom flora. I also thank the many taxonomists who attended the International Palaeolimnology Symposium in Canberra in 1993, the International Diatom Symposium in Italy in 1994, Pat Simms and Eileen Cox at the British Museum, and Frank Round at the University of Bristol, who examined my specimens. I visited the Environmental Change Research Centre, University College London, twice during the course of the project and am grateful for the advice and direction I have received from Rick Battarbee, Viv Jones, Steve Juggins, Roger Flower and thank Dan Bird and Dan Battarbee for assisting with rapid data entry and processing when my time was limited. Special thanks also go to John Carter encouraging me to make a record of the diatoms I encountered during this study.

Without Simon Wright of the Australian Antarctic Division, none of the fossil pigment work would have been possible. He selflessly instructed me in the use of his rp-HPLC and guided me through every stage of the analyses. Noel Davies of the Central Science Laboratory, University of Tasmania was equally invaluable with the Mass Spectrometry. Andrew Davidson also assisted on the rp-HPLC at various times. Finally Peter Leavitt's advice and encouragement throughout the study, and his comments on an earlier draft of Chapter 5 have been invaluable.

Kate Harle, of the Department of Geography, Monash University gave up her time to count the pollen from the sediment core. Her considerable efforts have enabled the analysis of the pollen record in the core and a reconstruction of the palaeoecology of the region.

Additional analyses were carried out at the University of Tasmania by Graham Rowbottom of the Central Science Laboratory (vibrational spectrometry), Barry O'Grady, Margaret Yam and Peter Triall of the Chemistry Department (iron and manganese), John Waters of the Department of Zoology (fish osteology) and Neville Cooper, of the Hobart Royal Infirmary (X-ray analysis). Barry Wise and Wayne Souter, of the Water Resources Department, Hydro Electric Commission Tasmania, willingly gave us both access to hydrological data, and instruction in the use of their data analysis facilities. The Commonwealth Scientific and Industrial Research Organisation provided tide data from Granville Harbour.

The Plant Science Department, University of Tasmania, headed first by Jim Reid and then Bob Hill, has greatly facilitated the smooth execution of this project and I particularly acknowledge the invaluable technical help and advice of Doug Madden and Lee Johnston. Gustaaf Hallegraeff and Andrew McMinn have also provided much sound advice. Amongst my colleagues and friends at work Rob Walsh, Martina Doblin, Lynda Bellchambers, Karen Westwood, Graeme Lush and Ian

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# **CHAPTER 1**

## **INTRODUCTION**